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RESEARCH ARTICLE

On *Lampyroidea dispar* in Bulgaria (Coleoptera, Lampyridae)

Denis Gradinarov[1], Fabrizio Fanti[2]

1 *Faculty of Biology, St. Kliment Ohridski Sofia University, 8 Dragan Tzankov Blvd, 1164 Sofia, Bulgaria*
2 *Via del Tamburino 69, I-53040 Piazze (SI), Italy*

Corresponding author: *Denis Gradinarov* (dgradinarov@abv.bg)

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Abstract

In this paper we provide information on the distribution and biology of *Lampyroidea dispar* (Fairmaire, 1857), based on males collected in Bulgaria. After its description, little research was conducted on this species. Here, for the first time, we provide habitus and aedeagus photographs. For comparison we also provide a photo of the aedeagus of *Luciola mingrelica* (Ménétriés, 1832).

Keywords

firefly, Balkan Peninsula, biology, bioluminescence, distribution.

Introduction

Lampyroidea A. Costa, 1875 (Costa 1875) is a small genus of Lampyridae (fireflies), inhabiting the eastern Mediterranean from Greece to Iran. It is present in Greece, Bulgaria, Turkey, Cyprus, Israel, Lebanon, Syria, Iraq and Iran (Reiche and Saulcy 1857; Costa 1875; Geisthardt and Day 2004; Geisthardt and Satô 2007). The genus, which includes only 13 species (Geisthardt and Day 2004; Geisthardt and Satô 2007), has always been understudied and this is reflected in the lack of information on the bio-ethology of the various species. In this document we present new data on the taxon *Lampyroidea dispar* Fairmaire, 1857 which is known from Turkey (Bosphorus) and Bulgaria (Fairmaire 1857; Gemminger and Harold 1869; Hicker 1925; Geisthardt and

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Satô 2007; Geisthardt 2013). For Bulgaria the species is reported without a specified locality (Geisthardt and Satô 2007). In the literature we also find a recent data and a photo of this species for Iran (Berger et al. 2021), which we consider not correct. Furthermore, the representation provided (Berger et al. 2021) is compatible only with *Lampyroidea persica* J. E. Olivier, 1907 having the pronotum with a black spot at the anterior margin. A drawing of the pronotum of *Lampyroidea dispar* is instead present in Olivier (1884). Little variable of *Lampyroidea dispar*, as small differences in size and in the black pronotal spot (Figs 1–2) appear in its range.

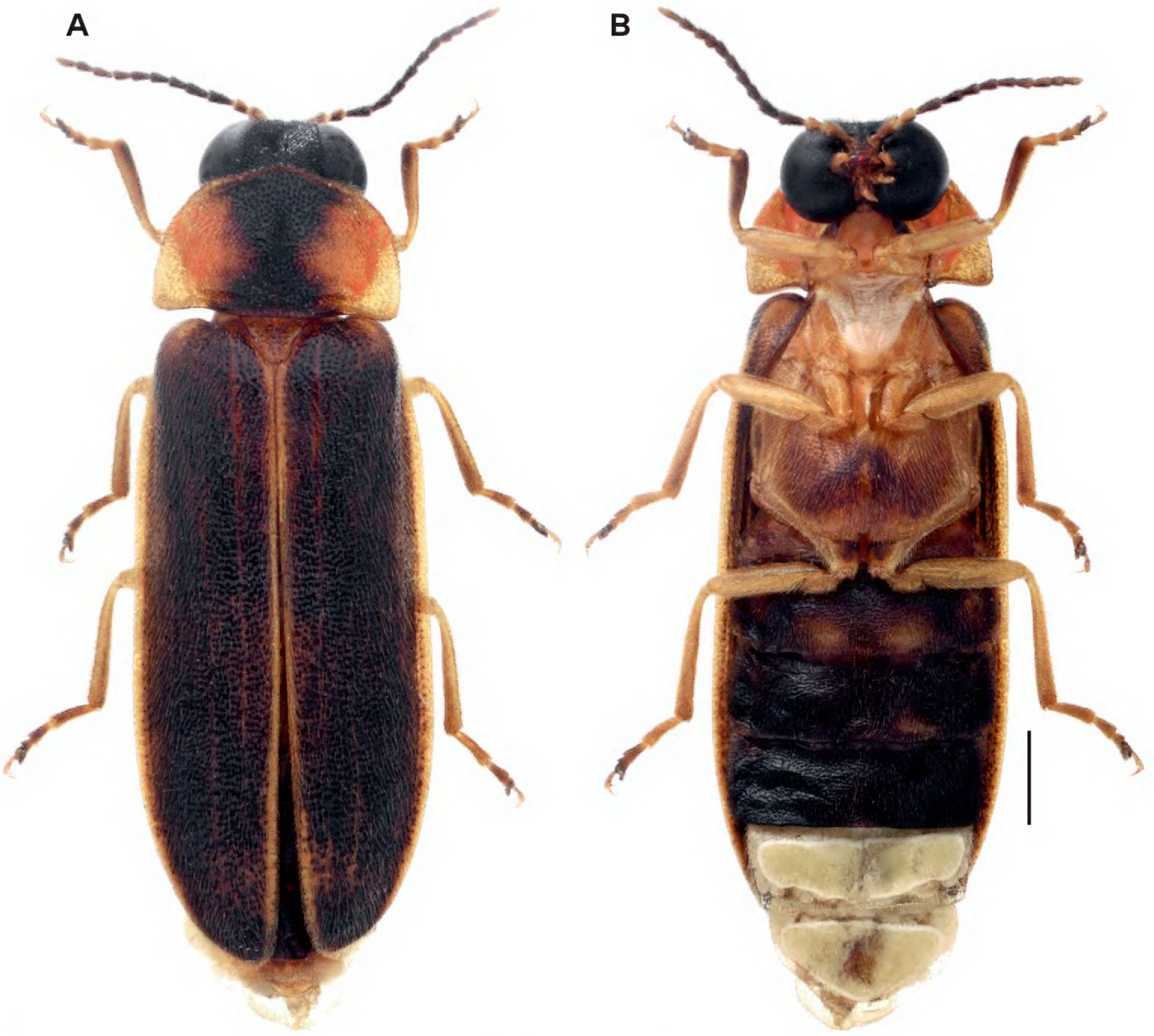

Figure 1. Habitus of *Lampyroidea dispar* (male from Sakar Mountains): **A** dorsal view; **B** ventral view. Scale bar = 1 mm.

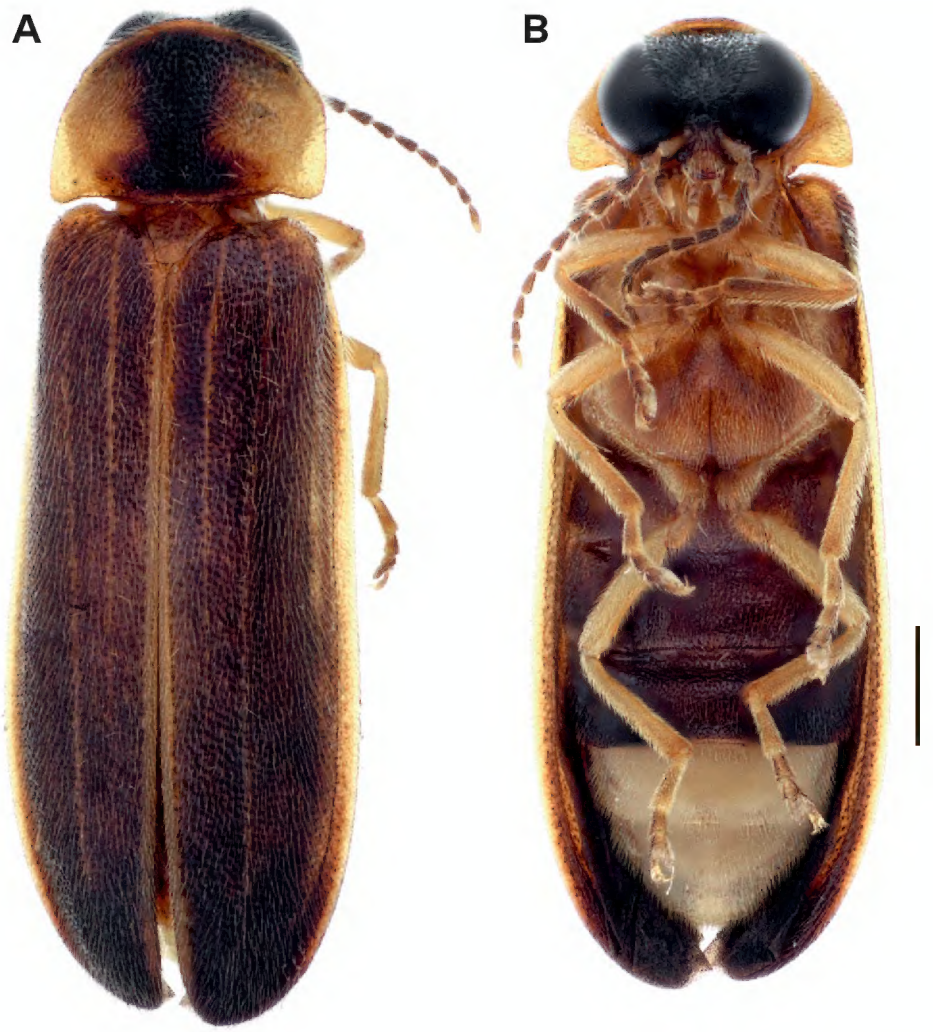

Figure 2. Habitus of *Lampyroidea dispar* (male from Burgas, Black sea coast): **A** dorsal view; **B** ventral view. Scale bar = 1 mm.

Materials and methods

Material for the present study has been collected in the period 2017–2021 from several localities along the Southern Black Sea Coast of Bulgaria and in the Bulgarian part of Sakar Mountains. Both regions are located in the Southeastern part of the country, not too far from the type locality of *Lampyroidea dispar* (Béikos, Istanbul). The fireflies were collected at artificial light or were captured in flight. Two types of light traps were used – automatic light traps and two portable work lamps placed on a white cloth. In both cases a combination of two 8W white and black tubes, powered by 12V batteries, were used. The automatic traps were left overnight, the work lamps were turned on at dusk and were periodically inspected for about two hours after sunset. The specimens were glued on standard tags or stored in ethanol. From two specimens the aedeagus was extracted for detailed studies.

The pictures of the habitats were taken using a Olympus SZ-30MR digital camera (Fig. 6) or a Canon PowerShot SX420 IS (Fig. 7). The other pictures were taken using a combination of Canon EOS 2000D digital camera, PRO-CA Camera Adapter and a Olympus SZ61 microscope (Figs 1–2) or Olympus BX41 (Figs 3–5). The examined specimens are preserved in the Zoological Collection of Sofia University "St. Kliment Ohridski", Faculty of Biology, Sofia (BFUS) and in the collection of the second author.

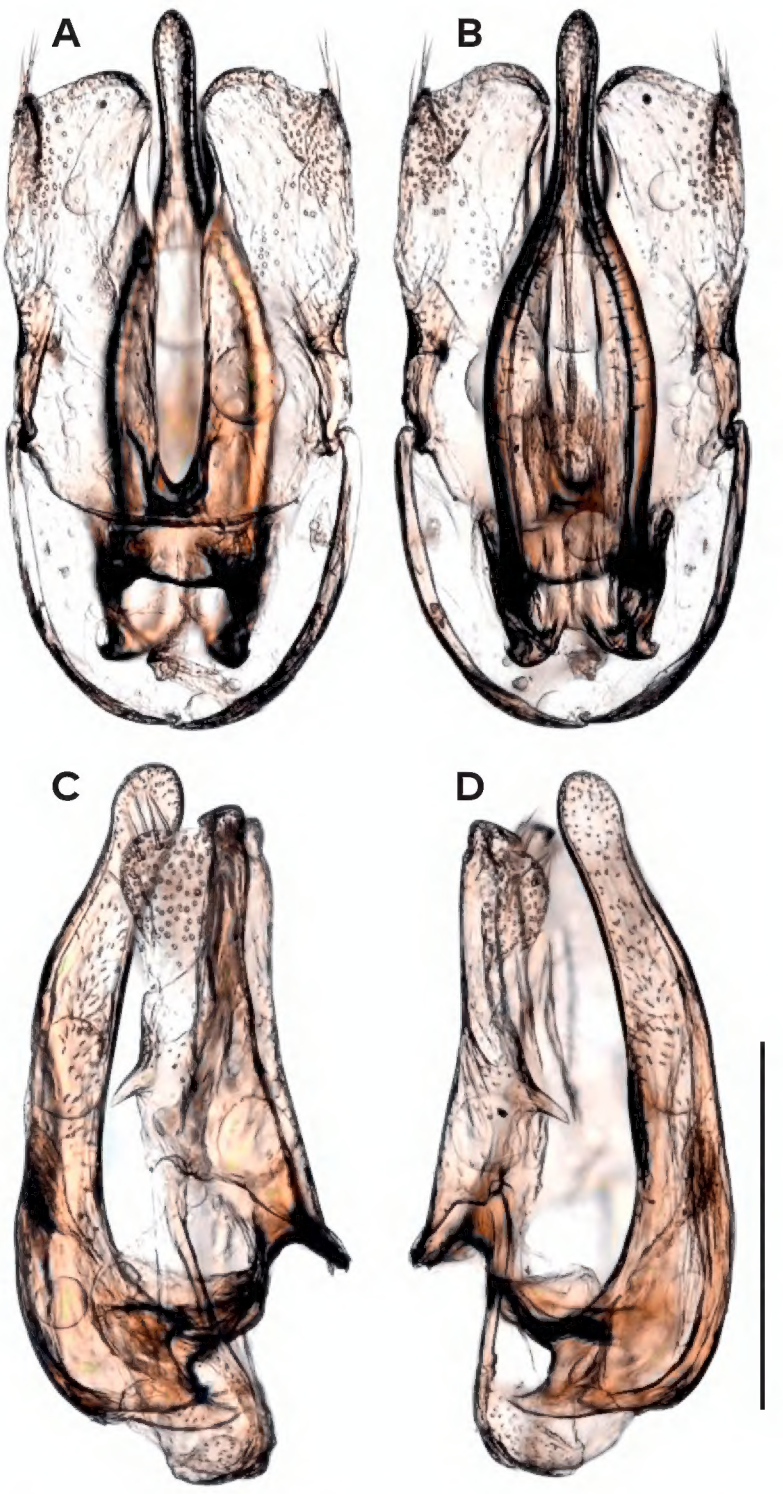

Figure 3. Aedeagus of *Lampyroidea dispar* (male from Ustrem Village, Sakar Mountains): **A** dorsal view; **B** ventral view; **C, D** lateral view. Scale bar = 1 mm.

Material studied

Bulgaria: Black Sea Coast, Rosenets Park, 7 km SE Burgas, 42°27.165'N, 27°32.931'E, 0 m a.s.l., beach and coastal vegetation, 04.vii.2017, at light (portable work lamps), D. Gradinarov & Y. Petrova legit, 1 male (BFUS, glued); Black Sea Coast, Rosenets Park, 9 km SE Burgas, 42°26.139'N, 27°33.560'E, 70 m a.s.l., edge of oak forest, 09–10.vii.2017, automatic light trap, D. Gradinarov & Y. Petrova legit, 1 male (BFUS, in ethanol); Sakar Mts, 6 km SE Topolovgrad, approx. 42°01.815'N, 26°20.852'E, 550 m a.s.l., oak forest with *Corylus avellana* L., 17–18.vii.2017, automatic light trap, Y. Petrova legit, 1 male (BFUS, in ethanol); Sakar Mts, W Ustrem Village, 42°01.449'N, 26°27.084'E, 100 m a.s.l., riverine vegetation, 12.vii.2020, at light (portable work

lamps), between 8:40 and 10:20 pm, D. Gradinarov legit, 1 male (BFUS, glued); the same locality, 22.vii.2021, at flight, 9:27 pm, D. Gradinarov legit, 1 male (BFUS, glued); the same data, 42°01.416'N, 26°27.130'E, 100 m a.s.l., 23.vii.2021, at flight, 9:58 pm, D. Gradinarov legit, 1 male (coll. Fanti).

Discussion

Lampyroidea dispar (Fairmaire, 1857)

Luciola dispar Fairmaire, 1857: 739. *Locus typicus*: "Béikos, dans le Bosphore".
= *Colophotia bosphorana* Dejean, 1836: 116 *nomen nudum*. *Locus typicus*: "Constantinop." [synonymized by Baudi, 1872: 100]
(Figs 1–4)

The genus *Lampyroidea* A. Costa, 1875 appears closely related to *Luciola* Laporte, 1833, from which it differs in the posterior angles of the pronotum not pronounced and not prolonged backwards which therefore appear to be about 90 degrees (Olivier 1884; Geisthardt and Day 2004), thus, with the posterior margin of the pronotum

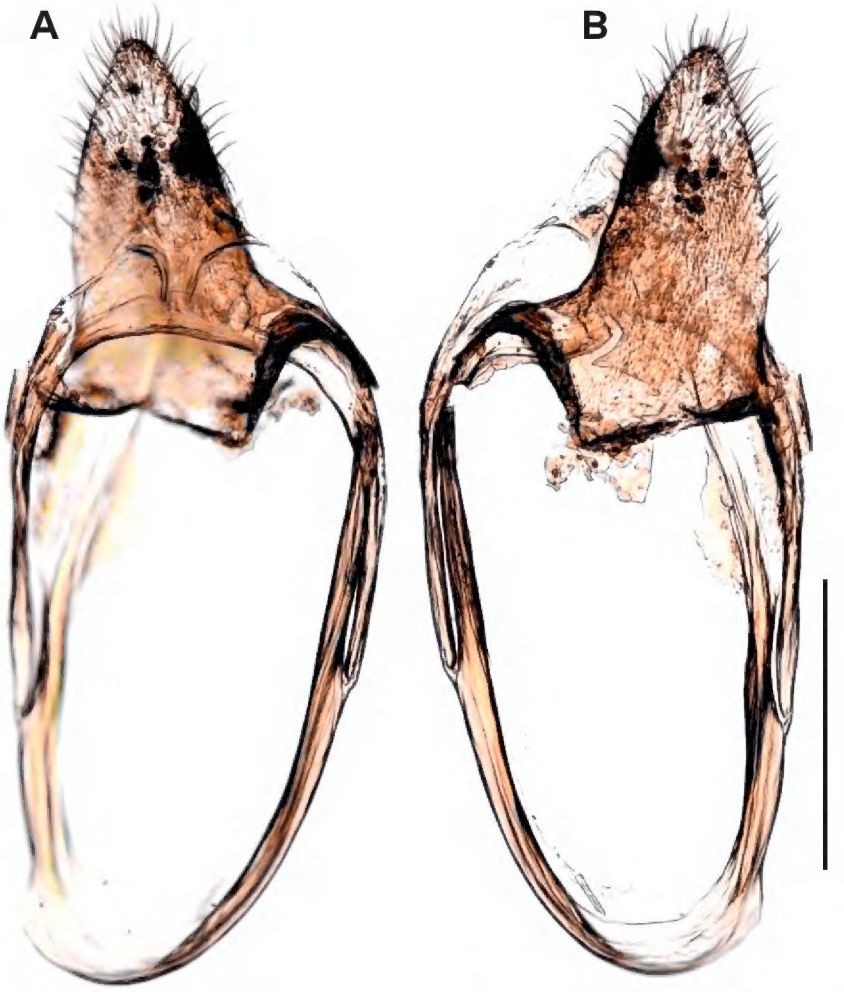

Figure 4. Aedeagal sheath of *Lampyroidea dispar* (male from Ustrem Village, Sakar Mountains). **A** dorsal view; **B** ventral view. Scale bar = 1 mm.

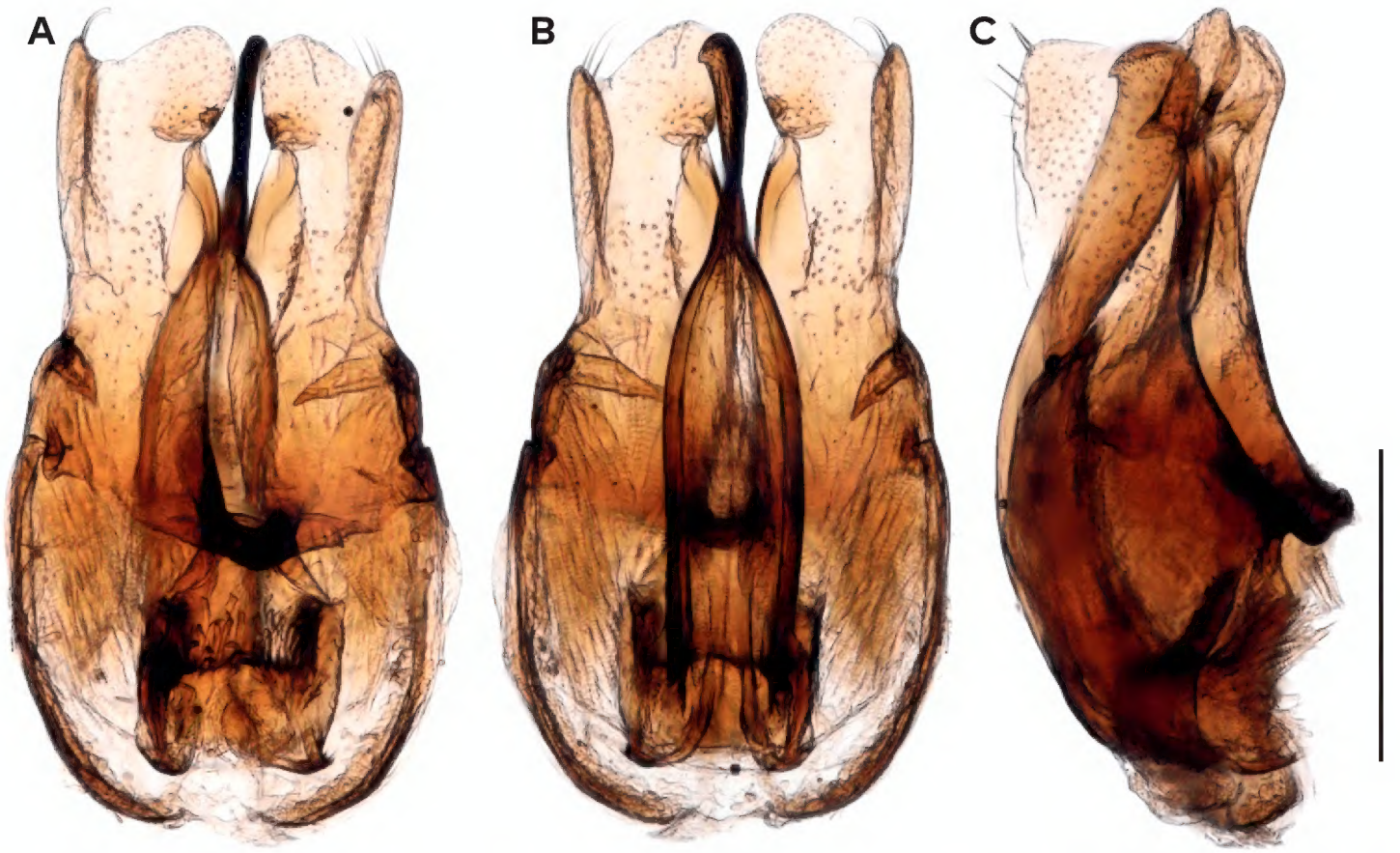

Figure 5. Aedeagus of *Luciola mingrelica* (male from Ustrem Village, Sakar Mountains): **A** dorsal view; **B** ventral view; **C, D** lateral view. Scale bar = 1 mm.

almost straight. The taxon studied here, *Lampyroidea dispar* (Fairmaire, 1857), appears to be quite rare compared to other species: *Lampyris zenkeri* Germar, 1817, and *Luciola mingrelica* (Ménétriés, 1832) present in Bulgaria, and appears similar to *Lampyroidea achaiaca* Geisthardt, 1999 from the Peloponnese in Greece (Geisthardt 1999). It differs from the latter (Geisthardt 1999; Berger et al. 2021) by the pronotal shape (Figs 1–2) and by the aedeagus (Fig. 3) with the median lobe (penis) not curved apically, while, *Lampyroidea graeca* (Laporte, 1833) has a very different color and shape of the pronotum (Olivier 1884).

A total of six male specimens of *L. dispar* were collected during our study, all in July. The species was found in different habitat types from coastline to about 550 m above sea level. In Rosenets Park, the specimens were collected on the beach (Fig. 6) and at the edge of an oak forest (*Quercus* spp.) next to swampy area and black pine (*Pinus nigra* Arnold) plantation. It was also collected in an oak forest in a locality SE of Topolovgrad (Sakar Mts). In the vicinity of Ustrem Village (Sakar Mts) all the specimens were collected on the bank of a small river near an agricultural fields and plantations of black pine on the opposite bank of the river (Fig. 7). The riparian vegetation is dominated by black alder (*Alnus glutinosa* (L.), black poplar (*Populus nigra* L.) and willows (*Salix* spp.). Riverside meadows with solitary walnut trees (*Juglans regia* L.) are also present in the study area. Several small swamps are located along the river bank.

The species appears to be widespread in the study regions, but only one or few specimens were caught in all localities during the study. However, this may not reflect

its biology, but may be due to the low efficiency of the light traps used for this firefly species or the late collection period during the year. Both specimens caught in flight during late July near Ustrem Village, were not attracted to the light trap used. Only these two specimens were observed and collected from the locality during four evening collecting attempts.

The males of *Lampyroidea dispar* emit bioluminescence from two large waxy white spots in the last two sternites, and almost as wide as the entire abdominal segments. Preliminary observations on the bioluminescence and flight were made for the two specimens caught in flight in July 2021. The specimens have been observed to fly about two meters above the ground, emitting light pulses at intervals of about one second or more. After the capture, the glow became continuous. The observed flight appears to be rather slow and in a more or less straight trajectory than that of *Luciola mingrelica*. For specimens for which this data is available, the flight period is for about half to one hour after sunset.

Given the similarity between *Luciola* and *Lampyroidea*, we also compare the aedeagus of the Bulgarian population of *Luciola*, which we attribute, not without uncertainty, to *Luciola mingrelica* (Fig. 5). This population has the pronotum with an evident black spot, where in the typical *Luciola mingrelica* this pronotal spot is

Figure 6. Habitat of *Lampyroidea dispar* from Rosenets Park near Burgas (Photo: D. Gradinarov).

Figure 7. Habitat of *Lampyroidea dispar* from Ustrem Village, Sakar Mountains (Photo: D. Gradinarov).

totally absent and its trace visible only with blacklight (Novák and De Cock 2017). *Luciola mingrelica* need revision, it appears a valid species, but often it is considered a synonym of *Luciola lusitanica* (Charpentier, 1825) (Geisthardt and Satô 2007).

Also, we have not yet found *Lampyroidea dispar* females or larvae during our studies. Females are apparently very rare and known only by a few specimens for a few species in the genus (Olivier 1884; Geisthardt and Day 2004). They are equipped with rudimentary elytra (Fairmaire 1857; Olivier 1884) which are very short and at most covering a quarter of the abdomen (Olivier 1907), with the females of *Lampyroidea dispar* being completely devoid of metathoracic wings (Fairmaire 1857). Probably, as for the Mediterranean species of the similar genus *Luciola* they do not fly, stay on the litter and are considerably fewer in number than the males. Even the larvae, we suppose, can be not very vagile and prey on snails under trunks and litter in areas with a good humidity gradient such as *Luciola*. New research in progress will therefore add important information to the knowledge of the genus *Lampyroidea* and *Lampyroidea dispar*.

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